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RESPONDING TO REQUESTS AT THE NATIONAL SPACE SCIENCE DATA CENTER

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GSFC — GODDARD SPACE FLIGHT CENTER —
GREENBELT, MARYLAND

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GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

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RESPONDING TO REQUESTS AT THE NATIONAL SPACE SCIENCE DATA CENTER

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Abstract

NASA's National Space Science Data Center (NSSDC) receives many worldwide requests for space science data; many varieties of machine- and nonmachine-sensible data are involved. Usually, data and services are provided for scientific research either free or on a cost basis. To handle the requests received, NSSDC has developed and put into operation a processing system and an accounting system. The Request Accounting, Status and History (RASH) file provides up-to-date information on the number of requests, their status, estimated and actual costs, and processing time. A microfilm retrieval system and a production-line tape reformatting system are two future goals.

Introduction

For the past 5 years, the National Space Science Data Center has responded to diverse requests for space science data and information. During our first year, the Data Center handled 378 requests; during the past year, we received, processed, and fulfilled over 1800 requests for space science data and information. These requests were from NASA, other government agencies, private industry, and academic institutions in the United States, and from scientists and institutions in 42 countries throughout the world. The requests, involving both machine- and nonmachine-sensible data, were for satellite and rocket data, correlative data, meteorological data, lunar data, ephemeris data, documentation, and computer programs. The primary data base from which the space science data and information are supplied is built upon a file that currently accounts for about 1400 satellites, 1900 experiments, and 800 data sets, and it is growing rapidly.

Since many information scientists and specialists are involved directly or indirectly in some form of request activity, we believe that the Data Center's experiences in handling requests, in developing and operating a request system, in encountering and solving problems, in facing the user charge question, and in charting a path for the future will be of interest, and perhaps of assistance, to other information professionals.

*The KMS Technology Center.

Background

The National Space Science Data Center was established by the National Aeronautics and Space Administration to provide for the dissemination and analysis of space data beyond that provided by an original experimenter. To fulfill this mission, the Data Center is engaged in the active collection, organization, storage, announcement, retrieval, dissemination, and exchange of space science data obtained from satellite experiments, sounding rocket probes, and high-altitude aeronautical and balloon investigations. Some specific disciplines covered are Ionospheres and Radio Physics, Planetary Atmospheres, Particles and Fields, Solar Physics, Astronomy, and Planetology (including Selenology).

The Data Center is operated by a staff of approximately 100 persons. The scope of work and type of effort involved in operating the Data Center are shown in Figure 1, which presents the main functions, the type of personnel involved, and the number of people involved in each function. Figure 2 is a functional model of NSSDC operations showing the relationship of the various activities being performed. (1)

As illustrated in the model, the NSSDC acquisition staff establishes contact with investigators, collects data and associated documentation, and provides work definitions to the supporting production staffs. In addition, the acquisition staff performs scientific analysis and special studies of the information in the Data Center. The production staffs operate interdependently. Their basic functions include computer processing services, generation of special computer programs, maintenance of the automated information files, storage of data, and preparation and distribution of announcement material. One additional service—unique in this context—is a research and analysis group established to support special studies undertaken at the Data Center. The request staff receives and services requests from the user community. In this connection, they identify tasks to be performed by the production staffs, and, for on-site data users, arrange for any support that is necessary.

In its daily activities, the Data Center handles large quantities of digital magnetic tapes, microfilm, photographic film, photographic prints, and sheets and bound volumes. The large amounts and wide diversity of data called for a systems approach in the operation of the Data Center. The development and implementation of the NSSDC Information System has required the use of microfilming, digitizing, and computing equipment and associated software.

Function	Types of Personnel	Number
Management	R&D Administration	4
Data Acquisition	Space Scientist	12
Systems	Planning and Development	4
	Analyst/Programmer	5
	File Maintenance	7
Computer Services	Data Technician	11
	Keypunch Operator	2
Programming Services	Programmer	9
Data Storage	Data Technician	8
Graphic Services	Photo Technician	7
	Microfilm Technician	1
Publication Services	Writer/Editor	5
	Technician	1
	MTST* Operator	1
Research and Analysis	Space Scientist	3
	Programmer	2
	Technician	2
Request Services	Request Agent	4
Administration	Administrative Assistant	1
	Clerical	6
	Total	95

*Magnetic Tape Selectric Typewriter

Figure 1. Types and Numbers of Personnel at NSSDC

The NSSDC Information System has been described in detail elsewhere. (2) (3) (4) However, the following brief overview of the system is provided here to show how the request processing activities fit into the total system.

The Automated Internal Management (AIM) system is the centralized source of information around which the other subsystems revolve. It is built upon detailed descriptions of the data, experiments, and spacecraft, along with information on the status of acquisition activity. It is used for logical searches, to determine workload/volume of expected data, to provide action reminders, and to provide management reports and indexes.

To be responsive to users who request data as well as those who provide the original data, the Data Center system must be sufficiently flexible to accept data in any format and provide it in any format. To this end, the Machine-Oriented Data System (MODS) is used for processing machine-sensible data into the NSSDC computerized data base, for data set analysis, for the generation of data set catalogs, for tape reformatting,** and for report production.

The Technical Reference File (TRF) is used to provide Data Center personnel with internal documentation support and a tool for satisfying the bibliographic needs of space science data users. It includes published and unpublished documents relating to spacecraft, experiments, and data sets that are or will be preserved at the Data Center. An important feature of the file is that Data Center scientists have established the keywording system and now do the keywording themselves, thereby eliminating the common gap between index- and user-selected keywords.

These three components of the system handle the activities involved in obtaining data and information, getting them into the system, and preparing them for retrieval. However, the greatest of systems is practically worthless unless it includes an efficient way of getting its product to the users and of keeping track of the users' needs. This is where the request processing system and the Request Accounting, Status and History file play a major role.

Request Processing

In addition to their overall request monitoring function, the Data Center's request services staff has specific responsibility for request verification, definition, scheduling, and distribution. Their functions also include identifying the materials needed to satisfy each request, maintaining contact with a requester, maintaining all records related to a request, and exercising quality review on all data and correspondence prepared for a requester.

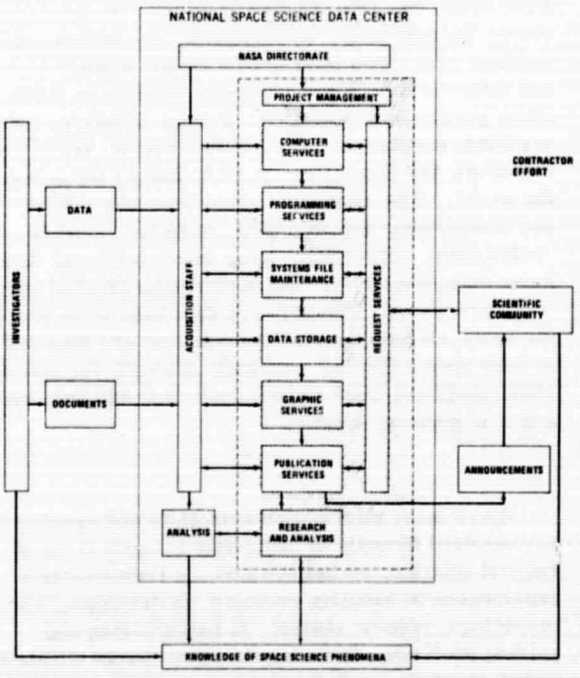


Figure 2. Functional Model of National Space Science Data Center

**This function is one of the tasks performed through the use of an NSSDC-developed package known as PIFT (Package for Information Formatting and Transformation).

Request Processing Cycle

All requests for data are handled in six stages: receipt, validation, definition, processing, completion, and follow-through, a process that may take a few minutes to several months to complete. A generalized flow chart of the processing cycle is shown in Figure 3. The request services personnel (known as request agents) control the flow of requests through these six stages. The vehicle for documenting all stages of request handling is the NSSDC Data Request Form (Figure 4). This form and its role in providing input information for the RASH file are discussed in detail later.

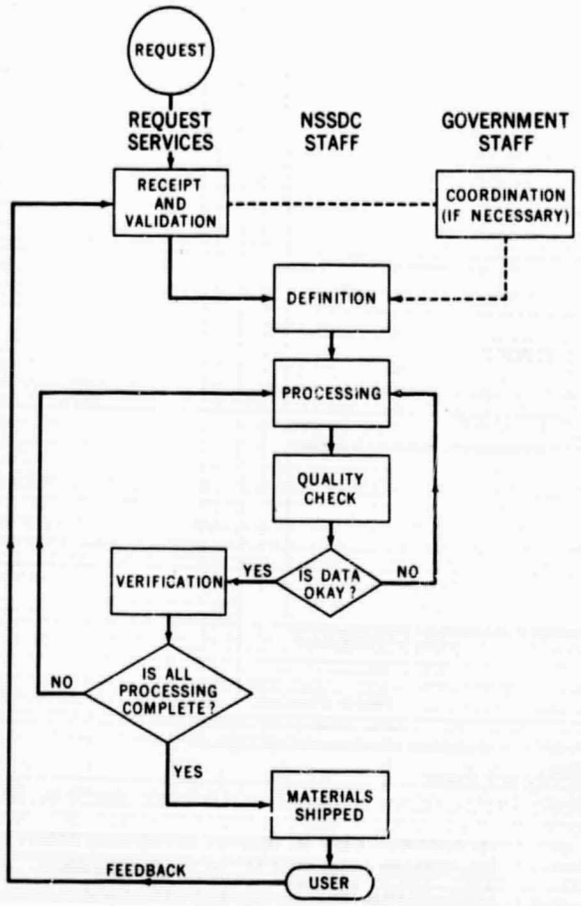


Figure 3. Processing Flow for NSSDC Request Services

Receipt. All requests, verbal or written, for data and information are directed to request agents for handling. A specific form is available for documenting verbal requests to ensure that there is always a written record of a requester's order. Each request is reviewed by the Request Services Manager to verify that it should be serviced by the Data Center. Requests for data or services that are not available through NSSDC are immediately referred to the appropriate office for response.

Validation. Requests from established users that are within the guidelines of the NSSDC charge and service policy (which will be discussed later) are handled in the manner described in the following paragraphs. However, when requests do not identify the intended use of the data or the scientific background of the requester, action is taken by the request agent to obtain this information prior to initiating processing activities. Any questions concerning the form, volume, reproduction costs, or difficulty in using the data are also clarified before beginning to process the request. When it is determined that data reproduction or service charges are required, the requester is asked to provide payment of the specific amount by check or postal money order. Once payment has been received and the request has been validated, it is assigned to a request agent for definition coordination.

Definition. The definition stage begins when a request agent receives an authorized request; it terminates when the request has been either prepared for processing or withdrawn. The request activity at the Data Center can be broken down into the following categories:

1. Requests for off-the-shelf items where no special reproduction is required to satisfy the request; i.e., the data or documentation required to satisfy the request is available in multiple copies. The request agent is responsible for all actions taken in regard to filling the request, and the processing step is skipped. Under normal conditions, this request category is completed within 2 to 3 working days of receipt.

2. Requests that are well defined when received and involve only the reproduction of data in a standard format, e.g., a request for prints of specific photographs or one for duplicates of several reels of microfilm. For these requests, the request agent precisely identifies the units (data) required by the requester and the work to be performed by the processing group. After production and verification, the processing group gives the reproduced data to the request agent for the completion stage. Processing time for this type of request will vary depending on the quantity of materials to be reproduced and existing backlogs in the processing group. Small reproduction tasks are normally inserted into the work queue ahead of very large tasks. The majority of well defined requests are completed within 3 weeks of receipt.

3. Requests that require definition and/or complex or special processing. Although these requests presently constitute only a small percentage of the request activity, they consume a large share of the Data Center's manpower resources. For this type of request, the agent contacts the person(s) in the Data Center who could most likely provide the

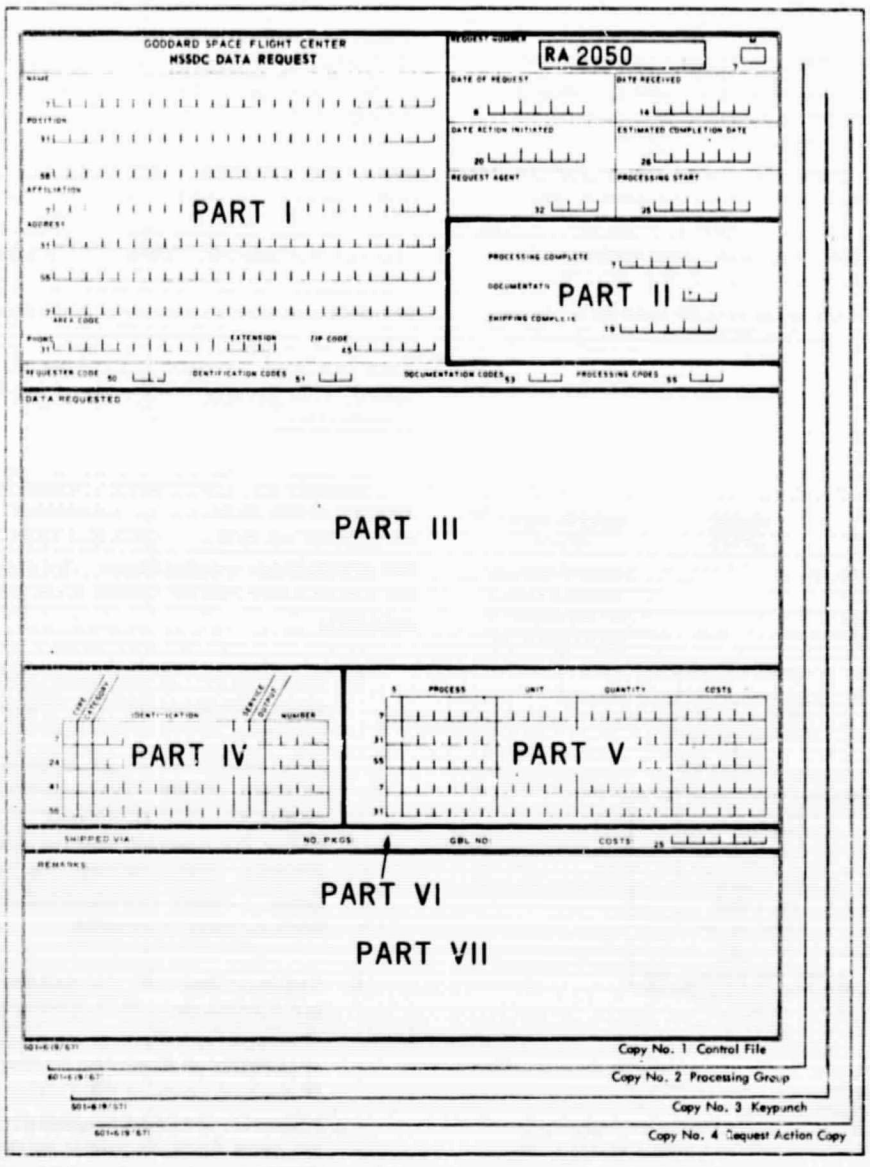


Figure 4. NSSDC Data Request Form

definition of the request so that processing can be initiated. In some cases the Data Center expert can provide a definition of the work requirements with little effort; sometimes, however, the definition may involve weeks of effort on the part of the Data Center expert and contacts with the requester, the experimenter who submitted the data, programming personnel, and others. The request agent often will not be involved in the actual definition of the request, but he is responsible for providing pertinent information to the RASH file on the status of the request. Once the processing has been defined, the request follows the same flow as described for the well defined request. One example of a request that falls into this category is: "We wish to correlate some summer 1967 and winter 1968 balloon measurements of electron bremsstrahlung X rays in auroral zones with satellite data on electrons in the magnetosphere. Data are required for (1) times when the satellite was at L values from 4 to 10 in the energy range 15-150 kev, (2) times when the satellite was in the geomagnetic tail in the energy range from a few ev to 150 kev. Do you know if these data are available, and where, for the following periods: 28 July - 13 August 1967 and 23 March - 7 April 1968?"

Processing. Once a request is properly defined and the instructions for processing are entered on the Data Request Form, a copy of the form and the request are sent to the group responsible for the processing. As the request is being processed, any problems encountered in filling the request are entered in the "remarks" section (Part VII) of the form. The processing group is responsible for providing the information

necessary to complete Part V of the form and for keeping the request agent informed of the processing schedule. The agent must also inform the processing group (in writing) if the status or estimated completion date of the request is changed. During processing, all status and scheduling information is entered into the Request Accounting, Status and History file, where it is accessible to the entire NSSDC staff. At the completion of processing, the processing group inspects the quality of the materials and gives the data reproductions and any special documentation regarding the data processing to the request agent. Copy 4 of the Data Request Form, with information to complete Part V and the "processing complete" date entered in Part II, is also returned to the agent at this tim .

Completion. Upon receipt of a completed data package, the request agent compares the processed data against the initial data request. If there are no problems, he then prepares a letter of transmittal and enters the "documentation complete" date on the form. The letter and copy 1 of the Data Request Form are forwarded to the Request Services Manager for review and then to the Shipping and Receiving Clerk, who makes a final check by comparing the labeling and identification of all packages with the items listed in the transmittal letter. As a general procedure, a copy of the signed letter of transmittal is included in shipments sent separately from the original letters. As soon as the materials have been shipped, the shipping clerk gives the request agent the shipping information for entry onto the Data Request Form (Part VI).

Follow-Through. Requesters' comments (feedback) regarding the condition of the data received or its usefulness are often received and forwarded to the interested persons. It is of particular interest to know whether analysis of the data made available by the Data Center results in published scientific papers. Plans are now being formulated for a survey of past users of our services toward obtaining comments on how we can better serve the user community. The RASH file (discussed below) should be invaluable in helping us conduct the survey.

Request Accounting, Status and History (RASH) File

The RASH file is the information subsystem used at the Data Center to account for the progress of request servicing. It provides our staff with up-to-date information on the number of requests, their status, estimated and actual costs, and processing time. This information can be searched and retrieved by data set, requester's name or affiliation, date of request, date filled, request agent, or request status. Detailed information on the input specifications, output reports, and RASH program documentation is presented in References 5 and 6.

All of the information contained in Parts I, II, IV, V, and VII of the Data Request Form is entered into the RASH file. The request agent uses both codes and free-text comments to complete the form. These are keypunched and entered into RASH at various stages of the request handling process.

RASH-generated reports on the accounting, status, or history of request servicing, which are provided to the NSSDC staff as required, serve as effective tools in the processing of requests. They do this by generating "action reminders" and producing timely displays of work queues, requester history, and data set popularity. RASH also aids in the construction of a dynamic model of the Data Center by supplying us with information describing the user community, the types of requests received, the kinds of responses required, and the data sets most likely to be distributed.

Among the reports currently being produced from the RASH file are:

1. NSSDC RASH File Listing
2. Summary of Data Request Services
3. NSSDC Request Accounting, Status and History Report
4. Data Request Master Log
5. Machine-Sensible Data Reproduction
6. Non Machine-Sensible Data Reproduction
7. Payments Received for Reproduction Services
8. NSSDC Special Request Classification
9. Action Reminders

Some of the more complex of these reports are explained below.

NSSDC RASH File Listing. This listing contains the complete contents of each RASH file entry (see Figure 5). In some cases, codes are expanded to a more readable form, but all data in the entry are listed out. This output is produced weekly for all active requests, i.e., those requests that were completed during the processing week or were in some stage of processing as of the last day of the processing week. This listing is also routinely produced on a monthly basis for all active requests and can be set to list all requests received after a given date.

Summary of Data Request Services. This report presents information on the number of requests (a) received, (b) in process, (c) in suspense, and (d) completed during any specified time period. It also breaks down the request activity into two user communities (GSFC and other than GSFC) and categorizes the request activity according to the type of data requested.

Figure 5. NSSDC RASH File Listing

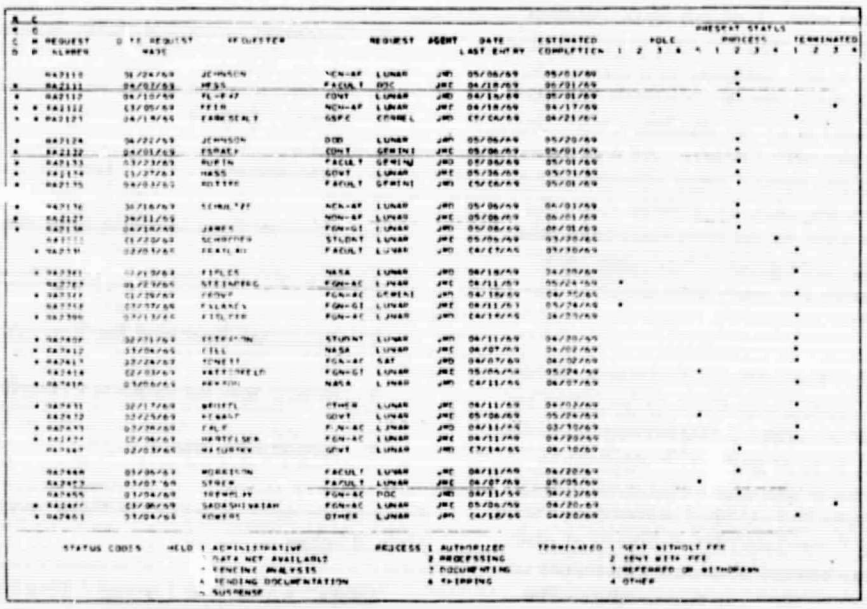
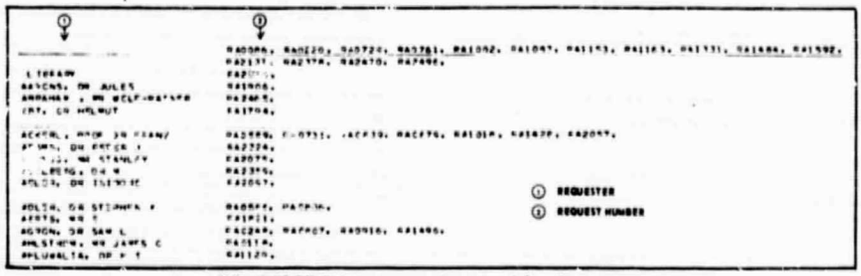


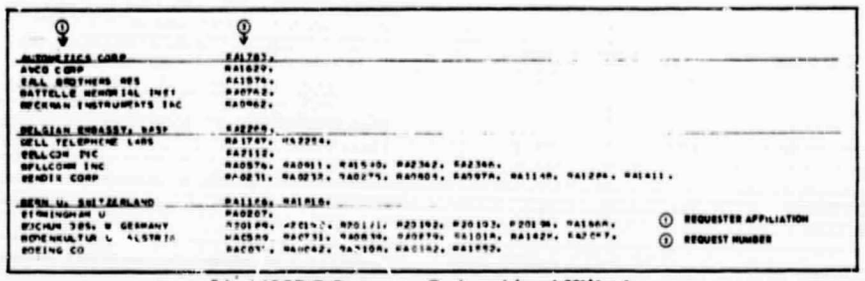
Figure 6. Request Accounting, Status and History Report Ordered by Request Agent

NSSDC Request Accounting, Status and History Report. This report consists of one-line entries pertaining to requests that are active or completed during any specified period. The output can be ordered by request agent, date of last entry, date of request generation (date request made), date of request authorization, or request status. A sample of the Request Accounting, Status and History Report ordered by request agent is shown in Figure 6. The last page of this report provides summary information on the number of requests received and completed, the total number of requests in each substatus classification, and the total number of requests in each major status classification (hold, processing, or terminated).

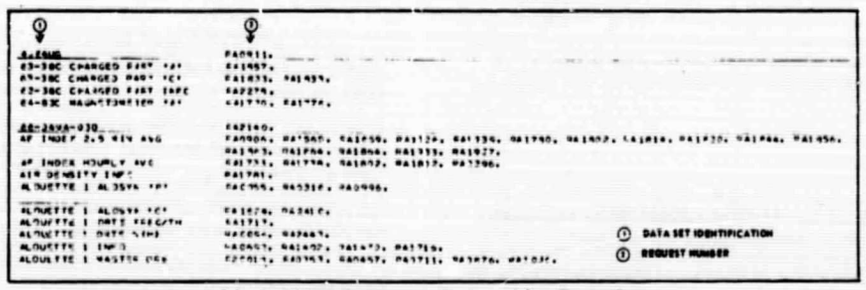
NSSDC Special Request Classification. There are three complete lists of requests produced weekly that identify the requests made by individuals and organizations as well as requests for each data set. The lists (Figure 7) are ordered by requester name, requester affiliation, and data set. These lists are quite useful to the request agents for determining the complete names and addresses of requesters and information about the data they received. For example, lists ordered by affiliation and data set could be used as a reference should a request be received from BELLCOMM, Inc., for Lunar Orbiter microfilms. The request agent first determines the request number for all requests received from BELLCOMM. He then checks the item "Lunar Orbiter 1-5 Pix, NSSDC" in the data-set-ordered list to see if any of the BELLCOMM request numbers appear. If there is a match, the agent uses the RASH File Listing to gather complete information about the previous BELLCOMM



(a) NSSDC Requests Ordered by Requester



(b) NSSDC Requests Ordered by Affiliation



(c) NSSDC Requests Ordered by Data Set

Figure 7. NSSDC Special Request Classification

request and, perhaps, finds that he can simply refer the new requester to a person in the same office who already has the required data. This has happened many times. Thus, the efficient utilization of the information presented in these three lists results in the savings of many man-hours of labor as well as in substantial cost savings for materials.

Action Reminders. Action reminders are automatically generated from the RASH file when the estimated completion date for an active request has elapsed, no action has been taken on an active request for 45 days, or the material is provided to a requester on a loan basis. Action reminders are sorted by request agent and contain the agent's initials, the request number, and the reason for the reminder.

System Evaluation

Request Products and Services

A systems discussion would not be complete without taking a look at the efficiency of the system. As a service organization, the Data Center must be in a position or develop the capability to provide a wide variety of services and products to its users. These have been discussed in detail in References 7 and 8. As mentioned previously, the Data Center must be able to accept data in a variety of forms and formats and then announce and furnish the data and documentation necessary to a variety of users. These user groups include scientists in the same and related disciplines, engineers and designers, planners, management, and educational activities. Table 1 shows a breakdown, by affiliation, of Data Center user groups for 1969.

Table 2 shows the number of requests completed in 1969 by the various categories on which records are kept. The total hours of computer time and the costs of materials, including magnetic tapes, are indicated in this table. In filling requests in 1969, the Data Center processed some 472 magnetic tapes, 10,800 xerographic copies, 2784 100-foot reels of microfilm, 16,734 photographic prints, 13,241 feet of film duplicates, 1100 miscellaneous photographic reproductions, and several hundred thousand pages of computer listings. The total man-years of effort involved in request processing accounts for approximately 20 percent of the total Data Center manpower resources.

Table 1
Summary of Requests by Affiliation Category for 1969

Affiliation	Number of Individual Requesters	Percentage of Total
Goddard Space Flight Center	389	21.7
Other Government Agencies (U.S.)	253	14.1
Academic Institutions (U.S.)	442	24.7
Private Industry (U.S.)	181	10.1
Foreign Scientists and Institutions	389	21.7
Miscellaneous	135	7.7
	1789	100.0

Note: Since one requester may ask for data from more than one category, we consider that a total of 1834 requests were completed in 1969.

User Charges

The Bureau of the Budget establishes the basic policies within the Government on charging for Government-rendered services, establishing fees to recover costs, and disposing of collected fees. (9) An important point to be noted is that the actual fees to be charged are based upon the direct and indirect costs to the Government activity supplying the services, but are not based upon the original costs of collecting the data.

NASA, implementing these policies, has authorized the Director of NSSDC to waive the fees for reproduction and dissemination of data and/or services if the cost of collecting the fee would be an unduly large proportion of the fee, if the data furnished are required to accomplish a NASA-approved research task, or if the data are to be used by a federal, state, or local government agency or by a non-profit organization. However, the Data Center must charge, regardless of the cost, for requests for data that are to be used for a private or commercial purpose.

Within these guidelines, the Data Center developed its basic user charge policy in April 1968. The Data Center furnishes data and/or services free of charge if the request is for a scientific or research project or for higher educational purposes and if the costs of the materials/services do not exceed several hundred dollars. So far, this policy has been effective; by adopting such a policy, the Data Center has been able to fill a substantial number of requests with its limited resources. The user charge policy also has been very effective in many instances in reducing a very large request to one of reasonable size. For example, the Data Center has approximately 3100 20- x 24-inch pictures from the Lunar Orbiter series of spacecraft. When these pictures were first announced, a large number of requests were received for complete sets. However, when a requester was informed that a complete set of pictures would cost $9300 ($3.00 each), the request shrank to a manageable size very quickly. In addition, it has been our experience that groups or agencies that have a legitimate need for a large amount of data are willing and able to pay for the data. Our problem is that funds received from a nongovernment source cannot be used by the Data Center, but are returned to the U.S. Treasury.

Although we do not intend to list specific user charges here, we feel that an explanation of the process used to develop such charges might be interesting. Our basic approach was to develop a method that would be acceptable as far as policy was concerned yet could be implemented by the Data Center with a minimum of effort and without requiring an elaborate internal cost accounting system.

Charges are based upon the actual costs of the supplies and materials and labor. A unit charge has been computed for each item based upon the cost to produce the item. The supplies and materials cost, i.e., the cost of the film, chemicals, reels, mailing boxes, Xerox copy, etc., is added to the labor cost for producing that particular unit. The labor cost is established by determining the average time to produce a particular type of reproduction, i.e., one 100-foot reel of 35-mm microfilm, an 8- x 10-inch transparency, etc. Since a number of professional and nonprofessional labor categories are actually involved, an average of their hourly rates is used to determine unit labor cost. To charge for the overhead activities of procurement and shipping and receiving, 50 percent of the cost of supplies and materials is added to the unit cost as the installation cost. An additional 15 percent of the sum of the supplies and materials cost, the labor cost, and the installation cost is added to cover NASA Headquarters costs (general and administrative cost) to determine the unit charge. In addition, the actual cost(s) for computer time (when appropriate) and mailing are added to the total cost of the request.

From September 1965 to April 1970, the Data Center responded to a total of 5680 requests. During this time period, records were kept on the amount of funds expended for supplies and materials and the maintenance of equipment, as well as on the computer time directly related to requests. Our records indicate that the total cost for fulfilling these requests far exceeds the amount we have collected. No records have been maintained on what we could have collected had we charged for all requests. However, our best estimate is that, even if we had charged for all requests and if we were able to use the money collected, this amount of funds would be only a small percentage of the total cost to support the Data Center during this period.

Table 2
Request Processing - 1969

Request Category	Total Requests Completed[1]	Use of Electronic Data Processing Machines (Hours)					EAM Equip.	Materials (Dollars)	Distribution of Manpower (Man-Years)
		7094	360/20	360/30	360/75	4020			
Rockets & Satellites	195	11.7	–	9.7	1.0	–	3.9	4800	3.80
Correlative	210	53.7	–	0.5	–	9.1	1.0	3600	2.05
Meteorological (Digital)	34	39.2	–	–	11.0	–	–	400	1.45
Meteorological (Photofacsimile)	106	–	–	–	–	–	–	600	0.55
Lunar Photos	786	1.7	–	0.2	–	–	1.5	6875	7.45
Gemini & Apollo Earth Photos	134	–	–	–	–	–	–	800	0.45
Documentation (Catalogs and general queries)	178	–	–	–	–	–	–	50	0.35
Data Exchange	59	16.4	–	5.5	–	–	1.9	650	0.50
Ephemeris	29	2.3	–	–	–	–	–	350	0.60
Program (Environmental Model, FIELD-FIELDG, B, L, etc.)	103	0.8	0.3	3.8	1.6	–	26.2	400	0.50
	1834	125.8	0.3	19.7	13.6	9.1	34.5	18525[2]	17.70[3]

[1]A request for more than one category of data is included here in each category to which it pertains. The total number of individual requests completed during CY 1969 is 1789.

[2]Includes cost of approximately $4845 for 323 tapes which were sent to requesters and which were not returned or replaced.

[3]Includes all manpower directly involved in fulfillment of external data and/or information requests (programmers, acquisition scientists, photographic technicians, etc.).

Operational Problems

As in other areas of endeavor, Murphy's Law applies to the request business. Because humans play a major role in the Data Center's request system, we have had our share of blunders—film negatives shipped instead of positive transparencies, prints reversed (mirror-imaged) from the negatives, one package of pictures mailed to Africa when it should have gone to a person in the U.S., copying only one instead of 12 files from a magnetic tape, etc. Although such incidents form a very minute fraction of the requests handled, each time we have learned something and either have instituted new quality control procedures or have made physical changes. For example, we were having a problem keeping track of reproduced data while waiting for the accompanying correspondence to be processed. (Many of the data packages are mailed separately from the correspondence.) To solve this problem, we completely redesigned the physical layout of the mailroom to keep better track of items being shipped. In addition, we upgraded the level of some of our personnel to reduce mistakes that could have been prevented by the use of common sense.

The errors we have experienced are common mistakes that can occur in any kind of operation. We consider these errors minor in relation to some other more serious problems we are having. For example, although we have some capability to process data on magnetic tape from one physical format into several others, we cannot produce self-documenting, machine-independent, densely packed standard format tapes through the use of a system software package. As a result, if we receive tapes in CDC 6600 format recorded at 1600 bpi on 7 tracks, and if the requester has an IBM 360/75 with tape drives to handle 800 bpi, a special program must be written to give him the data in a form he can readily use.

Also, over the past few years our information system has been developed to the point where it now contains much valuable information of use to request processing activities. However, now that we have the information in the file and are beginning to use it, we find that we cannot select certain kinds of information from the file and present it in the most convenient forms of output. The full AIM file now constitutes more than 4400 pages of computer listings; these listings are bulky and cumbersome for the request agents to handle.

The solutions to these and other problems are discussed in the following section.

Future Outlook

Just as in other activities, one must always be alert to improving services or providing the same basic service by a less expensive method. Toward this end, the Data Center is continually looking into new and better ways of doing things, and we are attempting to keep abreast of the new equipment technology entering the market. Some of the things we

are considering for helping us do our job more effectively are:

1. Greater use of computer-output-microfilm equipment for micro-publishing, for computer graphics, and for providing complete listings from our automated systems files. For example, we have already started on the 4400-page full AIM file. It can be produced on less than three rolls of 16-mm microfilm at less than 40 percent of the cost we had been encountering when running the listing on the IBM 360/30 line printer.

2. Development of an on-line, interactive information system to answer such questions as that cited earlier as being difficult to respond to. A preliminary feasibility study on such a system has been completed. Because of the cost and development time associated with the implementation of an operational interactive system, we are looking, during the interim period, into the possibility of using readily available microfilm information retrieval systems using cartridge microfilms and keyboard access to help solve our paper handling problem and to get at the information faster.

3. Further development of the Machine-Oriented Data System (MODS) for handling digital information in a more routine and production-like fashion. The majority of requests filled are for nonmachine-sensible data. It is expected that within a year or so a substantial increase in requests for machine-sensible data will occur. Thus, we will need to make greater use of MODS to handle digital data in large volumes. Another example of our current and expected use of MODS is illustrated by the case in which a set of data that consisted of 49 magnetic tapes generated by a CDC 6600 computer system was merged and compressed onto 9 IBM 7094 compatible tapes. Performing such actions routinely will result in substantial savings of computer time, data handling time, and overall costs associated with filling a request for a particular set of data.

4. Development and implementation of an SDI (Selective Dissemination of Information) system whereby information about new data acquired or planned to be acquired will automatically be sent to individuals who had previously expressed an interest in that discipline of study or in that particular kind of experiment. This system will enable us to more rapidly get information into the hands of the potential user of the Data Center's services. More important, it will give us concrete evidence on the expected use of the data. In this manner we can make more effective use of our resources by concentrating and giving priority to collecting those data having the greatest use potential, rather than routinely collecting data in a time-ordered fashion.

Over the past few years, the Data Center has developed and expanded our user services capabilities and the request processing system to the point where it operates smoothly. But it is imperative that we not become stagnant. We must continually look into new services that will have broad user interests and at the same time review our current practices. But the critical point is that we must exchange ideas and methodologies to mutually take advantage of the latest technologies in the information sciences by learning from each other.

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